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THE
HARVEIAN ORATION,
1881.

Per. 15082

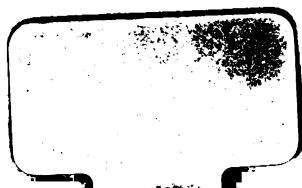
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From the Author.

THE
HARVEIAN ORATION.

ROYAL COLLEGE OF PHYSICIANS.

1881.

BY

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1881.

THE
HARVEIAN ORATION.

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MR. PRESIDENT, FELLOWS AND MEMBERS OF
THE ROYAL COLLEGE OF PHYSICIANS, AND
GENTLEMEN,—

Our late President, in assigning to me the office which I have undertaken to fulfil this day, very justly styled it an honourable and onerous task. In his kindness and partiality, he hoped that I might have something to say which would interest such an assembly as usually greets the Harveian orator. It can be no reproach if, in each succeeding year, the well-worn theme becomes more threadbare, and loses some of its original brilliancy. The enjoyment of listening to some of the most gifted of my predecessors must produce a somewhat unfavourable contrast when the work has to be accomplished by feebler hands. I cannot but feel that to give real vitality to my address demands a skill in oratory which I do not possess, an originality of thought to which I can lay no claim. I have purposely avoided looking

back to previous orations. A *pot-pourri* of the thoughts of others is not what I want to produce in this assembly ; and I am sure you will forgive me if, on the one hand, I repeat what has already been said so well by others, or if, on the other, I depart from the lines laid down by precedent as those on which this oration should be framed.

Though so far removed from the Harvey of the past, we may surely learn something from observing the way in which the great master worked. It is only by treading in his footprints that any one can hope to gain entrance into that temple of enduring fame in which he will ever hold so high a place. It was, indeed, no mind of ordinary stamp which animated the discoverer of the circulation. It does not appear that he had prepared himself by any special training for the work of his life ; indeed, it is quite remarkable that no record of devotion to science in his earlier days is anywhere to be found. It is true that when he entered the University of Cambridge he enrolled his name among the pensioners of Gonville and Caius College ; and among the MSS. preserved in its library is the original grant by Queen Elizabeth to the Master and Fellows " of the bodies of two criminals annually, condemned to death and executed in Cambridge or its Castle, free of all charges, to be used for the purpose of dissection, with a view to the increase of the knowledge of medicine, and the

benefit of the health of Her Majesty's lieges, without interference on the part of any of her officials." This grant was obtained by the influence of Dr. Caius, in the sixth year of her reign, just twenty-nine years before Harvey entered as undergraduate. Unfortunately, no record has been kept of whether the privilege thus conferred was ever used, but taken in connection with the existence of medical fellowships, it shows that the College was in those days marked as one specially devoted to medical science ; and we may, perhaps, be entitled to assume that some part of Harvey's subsequent career was due to this early training. That when he had finished his terms at Cambridge he left England to study in the school of medicine held in the greatest repute in those days, we all know ; and that he brought back from thence a very high testimonial of his skill in anatomy and physiology is also a matter of history ; but as yet we find no trace of the first steps of his progress. We can but picture to ourselves what a glorious awakening must have followed that early dawn when the idea first occurred to his mind that the blood propelled from the heart must return to it. "At length," to use his own expression, "by using greater and daily diligence, having frequent recourse to vivisections, employing a variety of animals for the purpose, and collating numerous observations, he thought that he had attained to the truth." He

had questioned Nature, and the early dawn had brightened into day.

Harvey's discovery came so soon after the publication of the *Novum Organon*, that it is not surprising to find in his writings phrases almost identical with those of Bacon, proving, as they do, that the general principles of that philosophy were congenial to his mind. But, to my thinking, he was not in any sense a logician, and did not attempt to frame his arguments on any defined rule. His was a mind to which a false argument was impossible ; he rejected it, not because he had applied to it any test of its logical fallacy, but simply because, to his clear intellect, the argument itself was unsound. I trust my younger hearers will not misunderstand me. The clear perception of truth, the faculty to analyse, and the power to grasp it in all its bearings, belong but to a few gifted individuals. Even to them, the cultivation of these talents is of the utmost importance ; to the great majority of us, such education of mind is absolutely essential if we would arrive at truth. Almost all the mistakes into which men of pure and simple aim have fallen may be traced to the imperfect development of the logical faculty. Without it true theories and correct practice are equally impossible. Where was it, we may well ask, when in Paris half a century ago, patients were actually bled to death in rheumatic fever ? Where is it now, in this enlightened

country of ours, as we draw on towards the end of the nineteenth century, when we find the sustaining treatment in enteric fever pushed to such an extreme that the alimentary canal becomes overloaded with undigested aliment, and the consequent tympanitic distension of the bowel bursts the slender bonds, which have hitherto saved from rupture the thinned walls of a deep ulcer, and the patient from a fatal peritonitis? Alas! medical science is ever bending the knee to the idols of fashion and prejudice, forgetful of her high mission, to seek after and follow only the truth.

I think we may trace, in the method in which Harvey first propounded his views, a very early attempt at the inductive mode of reasoning associated with the name of Bacon, which was then but in its infancy. In the light of further knowledge, the discovery of the circulation must be regarded as one of the most brilliant examples of that philosophy, surpassed perhaps only by Newton's magnificent discovery of the laws of gravitation, some seventy years later. All of these great thinkers were working on the same lines; imbued with the same spirit; each alike casting aside the dry logic of the schoolmen, which was once replete with life, but had become in their hands an almost unintelligible jargon.

In the recent revival of medical science—based, as it has been, on pathological research—one of

the greatest hindrances to progress has arisen, as it seems to me, from a misunderstanding of what Bacon meant. To many, it conveys no idea beyond that of the dry accumulation of facts, in the hope that some great truth may be elicited from their comparison. All honour to those who, in the past as in the present day, have made, and are making, our knowledge of various departments of medicine and the allied sciences more full and complete. But theirs is not the path which leads to such discoveries as those of Harvey and Newton. They have missed the first link in the chain. If I may venture so to speak of those who have done so much, they have missed the grasp of some great truth that ought to link together all those details over which the best energies of their minds have been spent. It cannot be too often repeated, with reference to this subject, that no two consecutive facts are exactly alike ; and that, as a consequence, the second observation does not fully confirm the first, but of necessity differs from it, in some particulars, to a greater or less extent. A mind that has grasped the cause of the successive facts, will regard only the differences, and seek for their explanation : a mind that labours after their simple enumeration will regard only the analogies. It is true that, by adding together the results of a large number of well-recorded instances, we obtain a general average, which is more or less correct in

proportion to the number of cases taken ; and they thus form the basis of what are called statistics. If I am right, it is of the very essence of statistics that each instance differs from the rest ; and that the very next observation made will necessarily be different from the average already calculated. For example : if one frame, from fifty years' observations, a curve indicating the average daily temperature at any given locality, it is almost certain that this year's curve will differ from the average ; and it is absolutely certain that a large proportion of the daily ranges of temperature will be quite different from those calculated for corresponding days from the fifty years' observations.

This was not what Bacon meant, or what Harvey did. His aim was to establish the law by which one of the great and essential processes of life was carried on, and that this law was constant and unchangeable. He showed that the circulation was just as certain as the heat of summer and the cold of winter ; but, in the law which he traced, there is nothing to indicate the quickness of the pulse—any more than, in the changes of season, can there be found anything to determine beforehand the degree of heat or cold which may be registered by the thermometer. He saw that the blood, propelled from the heart, must return to it ; he sought for the law of this phenomenon, and, having found it, was able to show that it was

unchanging so long as the heart continued to beat ; in fact, that it was a law of Nature.

If my memory serves me rightly, it is to John Stuart Mill that philosophy is indebted for the induction, that all laws of Nature, as at present known to us, are unfailing ; and, further, that this induction must form what logicians call the major premiss in every argument regarding such obscure subjects as—*e.g.*, in medical science—the origin of life, generation, development, growth, decay, and death. What, then, do we mean by “Laws of Nature ?” A law, if I understand the question, implies the existence of a Law-giver. It implies that if I, who am a living sentient being, acting and thinking for myself, am subject to such laws, there must be a Superior Being ; who is over me, above me ; who can give laws to me ; who can act, and think too ; one who meets me, when boasting of my own existence as the highest type with which I am familiar, as a higher Being still. Further : I feel that I must submit to these laws, and that their supremacy and duration are bounded only by the Will of Him who framed them.

I am not sure that this was what Mill meant. He conceived the laws of Nature to be immutable, eternal ; and I suspect that he based this belief on the ground that matter was eternal too—though he positively disclaims the necessity for any such supposition. If I mistake not, he believed that

each atom of matter had ever possessed the same properties which it exhibits now ; that these atoms associated themselves in certain groups, in consequence of their special requirements ; and that, out of these groups, certain definite results of combination occurred, which were like matter itself eternal, and, for this reason, entitled to be called "Laws of Nature."

Now mark that, from the very definition of the subject, it must be admitted that these combinations are secondary, not primary, and, as compared with eternity, are but of recent origin. One might concede to an exponent of this philosophy, that countless ages have passed since the first dawn of life in this world's history ; that, prior to that period, any most extreme duration was assigned to the slow aggregation of microscopical elements to form centres of spheres ; that, going still backward in dim and fading antiquity, atoms filled space before they had assumed such dimensions as even the microscope can take cognisance of. Let us grant that the atom at the centre of our solar sphere was but the beginning of our own system, and try to guess how long it must have taken to elaborate this small unimportant orb, which is yet all the world to us ; let him, if he please, add cipher to cipher in calculating this world's antiquity ; it is to me quite immaterial whether he multiplies his numerals by thousands or by millions ; it cannot be

of the slightest consequence how long he makes the total of his figures. They all have a beginning; eternity has none.

Let us just for a moment, by an examination of one of our most acute and most prized faculties, the sense of sight, try to conceive what this idea means. Let us accompany the astronomer into his observatory, where, in the glory of a magnificent starlit night, he gazes out on the heavens, decked in the splendour of countless myriads of stars. Some meteor gleams in fitful brightness across the expanse as it enters the region of our atmosphere. Further off, he knows that our moon revolves in regular circuit round the earth. Sometimes nearer, sometimes at greater distance, each planet in its own orbit revolves round the centre of the system. Beyond all these, reaching into boundless space, minute scintillations of light gleam forth, each possibly the centre of other harmonious systems of perpetual motion. With his present knowledge, the star-gazer has almost forgotten that, in long bygone days, there were astronomers who could reconcile their minds to the idea that our world was enclosed by a sort of crystal sphere, which, day and night, ever rolled round and round. He has actually measured how far we are separated from the nearer bodies; he has got the length of computing, with some degree of accuracy, the more startling distances which intervene between us and

a few of the fixed stars. From these data, he is tempted, by the help of the more perfect instruments of the day, to guess at the possible intervals between our system and the more distant lights. The nebulæ, which have been already resolved into countless myriads of stars, tempt him to conclude that those which he yet cannot solve are but more distant groups ; and thus a faint glimmer is borne in upon his understanding of the utterly immeasurable distances at which some of these self-luminous bodies stand from our insignificant sphere. So long as a foothold, however slender, can tempt the philosopher to spring from point to point in the contemplation of this marvellous whole, his mind seems to grasp, though but faintly, a picture of its immensity. Myriads of miles, such as an untrained mind can barely conceive, become to him little more than the inches on a mechanic's rule. But, even by him, a point is at last reached where the mind has no object to contemplate, no resting-place from whence it can make a fresh start. Beyond his farthest-reaching speculations there is still a beyond, and yet a beyond more distant still ! Surely the mind of man must recoil from any attempt to grasp the infinite. It is easy to argue in words that we ought to know the beyond from what we have already proved within the limits of our knowledge. But, if we ask ourselves the simple question what that beyond

is, and how far it may reach, I think we shall all admit that we cannot comprehend the infinite. Infinity is, but we understand it not.

So, too, of eternity. I make bold to say in this place that the man who talks of the eternity of matter knows not of what he speaks. It is a question that human reason cannot grasp, that logic cannot reach. One thing, however, comes out very clearly in the argument, which might almost have been predicated of the dictum when evolved out of the finite human understanding. Every speculation tacitly assumes a beginning for this evolution of matter. Eternity counts no beginning in its history. History, indeed, it knows not; duration is not of it; it is ever the same; a thousand years and the thousandth part of a second are just alike in that calendar; the limits of time and space are unknown; the present, the finite, the tangible, can scarcely be regarded as fragments of that great unfathomable abyss.

When I assert my belief in a Law-giver, it is because thus alone can I account for my own existence; its beginning and ending; and the existence of a world around me. That laws are impressed upon matter, and that it is governed by them, no educated man can deny; that matter framed these laws for itself seems to me to be too gross a hypothesis for anyone to conceive. Let me crave your indulgence if I further attempt to

define the meaning of the term "Laws of Nature." No greater hindrance to progress can arise than when, in the employment of scientific language, a restrictive sense is present to the mind of the person using it, which others are not aware of, and are consequently not prepared to adopt. It will be in the recollection of most of my hearers that not long ago, when the laws of the development of life during putrefaction were very much under discussion, Professor Tyndall announced an observation of some importance, as bearing on the subject. Dr. Bastian had cited experiments in which he found that in a certain putrescible fluid, the most rigid exclusion of the atmosphere failed to prevent the development of living organisms, and concluded that some other cause must be sought than the introduction of germs by that medium. Professor Tyndall, on the other hand, alleged that such fluids might be fully exposed to the atmosphere, provided it was so free from suspended matter that it seemed quite pure to a beam of electric light, and argued that the development of such organisms as are commonly found was due to the presence of impure air. Dr. Bastian's reply was short, sharp, and decisive. Professor Tyndall had not used the same fluid as Dr. Bastian, and the assertions made regarding a-bio-genesis applied to that fluid, and that fluid only, and to none other. Between the two philosophers, there could be

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neither agreement nor argument, because the one had mentally imposed a restrictive sense upon the terms employed, which was not recognised by the other.

The importance of this subject will be noted hereafter ; it has been mentioned here merely as an illustration of the need of clear definitions. But I think we may draw other useful lessons from the controversy which has occupied so large a portion of the days of living physiologists. It had been formulated as a law, that putrefaction and the development of living organisms bore some constant relation to each other. Its exact bearing had not been reached, but its application seemed to be universal. Here let me just observe the difference between a "law" and a "cause." The law merely declares the certainty with which the cause acts. The law does not compel obedience ; it merely shows how the result is to be traced, as the effect of some definite, though perhaps unknown, influence. In the case before us, the law was a very imperfect one, the cause utterly unknown. It had been suggested that, somehow or other, the presence of atmospheric air was essential, and experiments were being made to ascertain which of its constituents originated the change. Tyndall's experiment seemed to point to some ingredient mechanically suspended in the air ; other observations tended in the same direction,

and the law has thus been so far simplified, that it is now comprehended under the more general laws of the perpetuation of living beings on the earth's surface. The cause of life is just as distant and as obscure as before.

One more lesson let me deduce from the discordant views of these philosophers. *In limine* the questioning of Nature should have proceeded from both in the very same form ; the answers could not otherwise be in harmony. It is very remarkable that later observations have shown that there were special circumstances affecting Bastian's solution, not present in Tyndall's, which made it of some importance that the formula should have been exactly copied. On the other hand, it seems almost incredible that a law of Nature should have been based on a single instance, when all other experiments on similar substances failed to confirm it. In fact, it ought to have been regarded simply as an exception to the law, and the modifying circumstances closely investigated.

In attempting, then, to give a definition of the term "law," I wish merely to place before you the idea of what is present to my own mind in its employment. It may be regarded as a short statement of the certainty arrived at by our reason, that out of one condition another necessarily arises, and that the two conditions are associated together by some principle or mode of causation which may or may

not be known to us. Let us not imagine, however, that the law is the cause. I am afraid that many think and speak of the laws of gravitation as if they were the final cause of attraction. A larger body attracts a smaller one, not because it is larger, but because the principle of gravitation, whatever that may be, acts in proportion to its dimensions. This is one of the laws of its action, but the whole of these laws taken together do not explain its cause ; and I conceive that it may be said generally that all laws are liable to exception ; all causes operate uniformly.

No better or happier example of this difference can be cited than the suggestion of Adams of Cambridge, that the law of attraction from which the orbit of Uranus could be calculated was interfered with by some extraneous influence, which, for the time, modified the ordinary force, and produced an exception to the usual law. He calculated that a body external to it, moving in a similar orbit, attracted to the same centre, and attracting and being attracted by other bodies placed in relation to itself, would produce just such deviations from the recognised law as had been previously observed. By his calculations, he was able to indicate the exact portion of the heavens in which the planet Neptune was to be sought.

The lesson taught by this and similar instances seems to me to be this, that the cause of attraction

or gravitation, which is quite unknown, is always acting in a certain definite method, while the law of its action may seem to be modified for the time being. Hence it follows that when a true induction has been reached, these exceptions tend to prove its truth ; in other words, the exception proves the rule.

I trust that in endeavouring to call your attention to these points I shall not be judged to have deviated too far from the objects that ought to claim our attention on this Anniversary. I have but sought to bring out Harvey's own ideas in the language of modern thought. If we turn to his Deed of Gift, by which this annual Celebration was originally constituted, we find him saying of the person appointed to deliver the Oration that he shall make it "publicly in the said College, wherein shall be a commemoration of all the benefactors of the said College by name, and what in particular they have done for the benefit of the said College, with an exhortation to others to imitate those benefactors, and to contribute their endeavours for the advancement of the Society according to the example of those benefactors. And with an exhortation to the Fellows and Members of the said College to search and study out the secrets of Nature by way of experiment ; and also, for the honour of the profession, to continue in mutual love and affection among themselves, without which neither the dignity

of the College can be preserved, nor yet particular men receive that benefit, by their admission into the College which they might expect, ever remembering that '*concordiâ res parvæ crescunt, discordiâ magnæ dilabuntur.*'"

First let us note the evidence which this document contains of his great love for this venerable institution. I think that no one of us can read his life, study his works, or review his character, without feeling for the moment stimulated to follow his own example. He regarded the College of Physicians as a grand foundation. He looked to it in the future as the great centre from which the light of medical science and skill was to shed its lustre over England ; he hoped that the College was to be the teacher of her people, the adviser of her rulers, and the training-school of her medical men. He sought to help in this development ; and while he made the old physicians' hall his school of medical philosophy, where he for so many years taught his new doctrine, he sought also to bind in the bonds of friendship those who met in solemn conclave to determine the great questions of the day.

It must be confessed that until recently his hopeful anticipations have not been realised. A narrow and exclusive jealousy grew up in place of the large-hearted sympathy which he had hoped would guide the steps of the Fellows of the

College ; and it was not till the fatal Act of 1815 brought the certain Nemesis of overweening pride in the general lowering of the status of the profession, that any one seemed to think that there might be a nobler future in store for its Fellows. It had become little better than a gossiping club for Oxford and Cambridge graduates in medicine, with the select few whom they admitted into the Fellowship.

The origin of all this is not far to seek. The first failure lies at the door of the older universities of this kingdom. I will not venture to inquire how all the trusts placed in their hands have been discharged, but there can be no doubt that one of the most sacred—the encouragement of the study of medicine—has not had in times past the fostering care of either Alma Mater. Harvey himself left Cambridge to study in Italy, and from that day forward so little has that branch of science been regarded, that foundations set apart for its advancement have been awarded wholly on account of other distinctions, even to men who never opened a book on medicine and the allied sciences. It is true, indeed, that the English character has developed in her public schools and universities in a way that seemed to defy all antecedent probability—that the majority of those who have passed through the curriculum bear in after life the hall-stamp of gentlemen, and that a few have

distinguished themselves as critical scholars or as pioneers in the path of scientific research. For teaching purposes beyond the limits of classical and mathematical study, the English universities were for long ages practically without resource. Medicine seemed to a certain extent to be secured by the foundation of professorships, fellowships, and scholarships; but in the general lethargy it failed to awake any enthusiasm in England, and Edinburgh stands pre-eminent as the teacher that first drew away students from the foreign universities. The titular M.D. of Oxford and Cambridge necessarily sank in general estimation, while the graduates arrogated to themselves the rights and privileges conferred by the charter of the College.

From such a state of languor and depression a reaction was unavoidable. Outside the College, a strong phalanx of medical practitioners arose; inside the College, many a keen-sighted observer foresaw the doom which awaits exclusive mediocrity. Measures to stop the advancing tide have been eagerly grasped. Much has of late been done to raise the status of the profession; but at the present moment no prophetic eye can clearly discern the issue. So long as scientific workers are content to labour in a field where the hire is so small and the fruit so slow in its growth, increase of knowledge must be gained, progress

must be made. But whether practical medicine is to drift into a trade in which the breath of popularity alone raises a man above his fellows, or is to mount into that position in which the esteem of those competent to judge shall be the only portal to eminence, who can say? It is for the younger Fellows of this College to choose which path they will follow; and may God defend the Right! Let me entreat them, in the words of Harvey, to imitate the example of past benefactors, and to contribute their endeavours for the advancement of this Society according to that example, and to search and to study out the secrets of Nature by way of experiment.

And here it is natural to ask how far of late years students have regarded this course as the only sound basis of scientific knowledge and practice. Time would fail me were I to attempt to analyse all that has been done in the various departments of pathology, and endeavour to sift the wheat from the chaff. I propose to select two only among the salient subjects of observation and discussion, and compare them together from this point of view.

Harvey's name comes down to us as a great physiologist. No theory of inflammation arose in his mind out of the discovery of the circulation. He did not waste his energies on idle speculations; but, assuming the necessity of some hypothesis as

the starting-point in the inductive method which he followed, he saw clearly that it was valueless until he had put it to the proof by questioning Nature. Few among that vociferating crowd of anti-vivisectionists know that he did not shrink from observing for himself what was going on in the circulation of living animals. If he had not done so, he could not have obtained the sure answer to his questions—the proof of his hypothesis. The answer was in his case definite and unmis-takeable. There was no longer any possibility of denying the truth of the facts, or disputing the conclusions deduced from them. It is much to be regretted that some philosophers of the present day, some close observers, have been content with a line of argument falling short of that certainty which, in my opinion, is at all times true of what I have already classed as laws of Nature. When the questioning of Nature has not produced an answer in accordance with their expectation, it has been not unusual to substitute a pretty and perhaps plausible theory as the main prop of the hypothesis, in place of abandoning it as a delusion which could only lead away from the strict path of scientific truth.

The survival of the fittest is by no means a new idea among physiologists. It was recognised, in its relation to the many varieties of the races of man, by Pritchard, when he wrote on this subject

nearly seventy years ago. He used it as an argument in favour of the unity of the human family, which even in those days was sometimes called in question. Its importance was overlooked chiefly because philosophic speculation set in a current opposed to the idea that the high mental culture of Europe could belong to the same race of beings as those who adored a fetish in South Africa. It was evident that some other principle was involved when, in the vast continent of America, a copper-coloured race of a comparatively low type of humanity had taken the place of a people who had left behind them evidences of a much higher state of civilization at an earlier period. In the old continent, events of the same kind had happened. Long ages ago, the treasures of Nineveh had been buried, and over the mounds under which they lay hid wandering Arabs had reared their tents. The wisdom of Egypt has long since perished ; but the huge masses of solid rock out of which her ancient monuments were constructed still remain, amid a debased and degraded population. The Greek race has abandoned its high intellectual eminence ; the Roman Senate has ceased to rule the world. These considerations gave rise to speculations which influenced the theories of the last generation. The survival of the fittest could hardly offer a solution of changes such as these ; and rash hypotheses regarding the origin of species obscured the ques-

tion of the origin of varieties. It was contended by some that human beings so utterly unlike each other as some of these races are must have sprung from distinct progenitors, who had come upon the earth's surface at different times and at distant localities. Such a suggestion was very naturally met by others with the assertion that all belong to the same species.

Here let me just observe that, in the employment of the term species, I mean merely to convey the idea that, however closely any animals are related to each other, they do not belong to the same species if it be ascertained regarding them that the union of the sexes does not produce a prolific offspring. It is quite immaterial to my purpose to inquire further into this proposition, or why it is that the hybrid product of the union, when any such takes place, is incapable of producing progeny; it is only necessary here to define the sense in which the term is employed. I may further add that, whether this word continue to be used by scientific writers, or any other term be substituted for it, the law of Nature remains, and must be recognised. This has, no doubt, deprived much of the contention of its interest, so far as man at least is concerned, because nowhere is there any barrier to the propagation of the species. It has, indeed, been asserted that the mixed breed of certain races has degenerated and died out. Were

this proved, it would go no further than to serve as an illustration of the survival of the fittest within the limits of the species. No one has ever ventured to assert that the fruit of these mingled races could not themselves intermarry and produce fruitful offspring. The unity of the species remains unquestioned.

The subject of survivals has again been brought into prominence, in connection with Professor Darwin's theory of natural selection, by a certain section of philosophers, who profess to range themselves under his banner. The wild speculations which now pass current under the name of Darwinianism, start with the assumption that if there be apparently no limit to the origin of varieties within the bounds of species, there should be no difficulty in the transition from one species to another. I do not propose to argue the grounds on which this assumption is supposed to rest. I would only ask whether Nature has been questioned in the sense which Bacon and Harvey alike propose, and what answer she has given. I am not exaggerating the opinions held by these advanced thinkers, in saying that one of their dogmatic beliefs is that no single species has been throughout its history quite unconnected with other genera or species than its own, or was evolved at any one particular time or place in the world's history. It has been pointed out, without altering the current

of modern thought, that in the fossil fauna of past times, there are many examples of extinct forms of life alongside of many existing in the present day ; and that while both may be grouped under genera and species, there is no transition form discoverable bridging over the line which defines the limit of species.

Popular as these speculations have become, in consequence of the charm of the writer's language and the wide scope which the play of thought may, in imagination, reach in reading Professor Darwin's beautiful illustrations of natural selection, they seem to me to want all that could give them firmness or stability. The conclusions, which may possibly be true, with reference to the origin of varieties, cannot be applied to the wider field of the origin of species without some kind of evidence that Nature has worked in this way. Many of her laws are yet unknown. The growth and the decadence of nations are problems which yet await solution. The high culture of European races, as contrasted with the moral degradation of the negro tribes, has not been brought into the domain of any definite law ; but, in my judgment, what is popularly known as Darwinianism has not added one new item to our scientific knowledge, and cannot be commemorated as an instance of the real progress of science in a Harveian Oration. I would here broadly assert that no law of Nature

has been enunciated by which our origin, as we meet here this day, can be presumed to be derived from an anthropoid ape ; no lapse of time can suffice to trace the human form divine, back to some primeval mollusc, or find its beginnings in the existence of an infusorial animalcule. Surely no one imagines that, in the recent revelations of the microscope, we can hope to search successfully for the first germs of life on our planet ?

In a totally different direction, these minutest organisms have come to hold a very important position in the view of the real student of Nature in the present day. We must pass on mainly to their pathological aspect, though not losing sight of their physiological importance. I have already referred to the vexed question, which so long occupied the attention and stirred the antagonism of microscopical observers. Whether it has yet been finally settled, or is now only at rest while the opposing forces are preparing for a fresh encounter, I know not. The question was simply whether life could spring out of inert matter which had itself once attained to any of the functions of life, or had been at any time indirectly associated with some living organism. Could it, in its separate state, retain such a degree of vitality that life of the lowest form could spring out of its disintegration ? Was it possible that such matter could, by its own molecular changes, give rise to

living organisms capable of rapid reproduction ? I confess that I have always ranged myself with those who believed that the newly-developed organism commenced in the same germinal form which afterwards served for its propagation. Let me not be misunderstood. There is nothing irrational in the conception that these minute organisms may either produce fully-matured spores or germs, or may be propagated by fissure and subdivision. The word germ "may," for the present, be fairly applied to the immature object of either kind, which afterwards develops into a living being.

All the hypotheses which have been suggested in connection with the propagation of this lower stratum of life, revealed, as it has been, within a comparatively recent period by the more perfect optical instruments of the present day, have gone on the assumption that their development demands the presence of some force different from that which we find in constant operation ; and the further question opens a wide field of controversy—viz., What is that force ? The minutest of these creatures are invisible to the highest powers of the microscope in the solution to-day—to-morrow they are swarming in hundreds or thousands. How is this ? Has any other change in our solution taken place, and is that change constant ? It was very easy to confute Mr. Cross, who put forward the suggestion that electricity had the

power to develop animal and vegetable life, when it was found that, if other circumstances remained the same, the life was developed without the presence of electricity. But it was not so with regard to chemical change. Putrescence or fermentation was found to be almost invariably present; and there was evidently some correlation between the two facts thus established. So far, the law of their being was, with a few exceptions, absolute.

The law was absolute, but indefinite; and the existence of exceptions made it necessary to seek for a clearer insight into its meaning. The hypotheses which have been suggested divide themselves into three main classes. First, there was the old popular belief that putrefaction breeds worms, refined and transformed by scientific research into the statement that during the devitalisation of previously living organic matter, new life in another form sprang into existence—in principle, perhaps, not unlike the present view of the conservation of force. Secondly, there was the view, diametrically opposed to it, that the germ comes from without, and by its presence and power of development excites the chemical change which accompanies the presence of the fully-formed being. Thirdly, that the putrefying or fermenting material offers a suitable nidus for its growth and development. The first, I think one may say, has for the present passed into the region of oblivion. The second has

been recently engaging the attention of an ever-increasing number of enquirers. The third still counts a few trustworthy observers, and certainly contains some element of truth, the exact import of which has not yet been determined. For example, the *oidium albicans* appears in certain forms of mal-nutrition, while in others its presence has not been detected. Again, how curious to note the appearance of the milk bacillus almost simultaneously with the conversion of an out-building of a farm into a dairy.

It is to the second hypothesis that I specially wish to call your attention in its bearing on the causation of disease. Probably no name has become more widely associated with this view of the question than that of Lister. Ever since scientific observation has been associated with the practice of surgery, union of parts by what is technically called "the first intention" has been the great aim of the surgeon. Suppuration, and especially unhealthy suppuration, has marred the results of the most skilful operations. Mechanical and chemical aids have at various times been suggested, and have been more or less successful in the hands of those who introduced them; their subsequent adoption or rejection by the profession has depended very much upon whether, in their more general use, they justified the anticipations which had been formed concerning them. I think they may

all be said to have been based on one cardinal principle—viz., an attempt to exclude air from the wound. To some the air seemed to produce evil consequences by its coldness—to some by its dryness—to others by a kind of stimulating property; but to Lister's mind it occurred that the evil depended not so much on the air itself as on the impurities it contained. Among the floating particles were unquestionably those germs which the biologists of all schools were so busily trying to exclude from their solutions and infusions when discussing the origin of life; and these he endeavoured to exclude from his operations by the employment of germicides and cotton-wool. It is not for me here, as a physician addressing physicians, to attempt to estimate the value of his results. The hypothesis is one that claims the earnest consideration of surgeons, and the practice which it suggests numbers now a large number of adherents. I need only add one word of caution in weighing the arguments on one side or the other. If these germs abound, as we are led to believe they do abound, and if their exclusion be a matter of such delicate manipulation that it has stirred up the strife of two opposing parties of scientific enquirers for a long series of years, it is unquestionable that the precautions necessary for their exclusion or death must be most minute. True conclusions as to their influence on the divided

tissue cannot be attained by any rough and ready method. If germs are to be excluded, they must be shut out without an exception—if they are to be destroyed, the death of every fragment, every spore must be accomplished with the minutest care, or the experiment will necessarily fail so far as it is to be ranked as proving a law of Nature. The partial exclusion of atmosphere dirt may exercise a certain amount of beneficial influence ; but it is impossible to appreciate it at its proper value in dealing with so complex a problem.

A much more engrossing aspect of this lower stratum of life presents itself to us in this Hall, when we turn to the consideration of the question whether these germs in the widest sense of the word have anything to do with the propagation of disease. Our means of research are probably yet far too limited to enable the most patient and painstaking observers to penetrate far into such mysteries. But I must confess that, as I have recently read some of the revelations which the microscope has already made, as I have followed some of the results obtained by the cultivation of these minute organisms, it has seemed to me that a vista was opened into a new region, that to our successors, if not to ourselves, a new era was about to commence, which might bring about a most complete change in the science and practice of medicine. Probably none of those early inquirers

who first argued the questions of homo-bio-genesis, a - bio - genesis, and hetero - bio - genesis, had the remotest conception that these questions bore any relation to the spread of small-pox and the influence of vaccination, or were directly involved in the development of anthrax and splenic fever. The inquiry began as a matter of purely physiological research. What was the life history of a bacillus? What were its parentage, development, and offspring? What were its relations to other beings, and to inert matter?

The history of this investigation affords a remarkable illustration of the manner in which the observation of facts, guided by a scientific aim, and prompted by a keen perception of the bearing of scientific truth, has led on by slow degrees to the development of a view of life consistent with itself, and closely interwoven with all that was previously known.

No great discovery has marked any step of its progress, no startling hypothesis has overturned the conceptions of a past age; if we exclude the possibility of its being hereafter proved that each specific disease has its own parasite. The descent from the examination of the higher to that of the lower stratum of life has followed naturally on the improvement of the optical instruments now in familiar use. The germ-theory of life is only the application to the lower classes of what was already

known of the higher classes of organised beings. The observation that each of these creatures was distinctly differentiated was no more than the differences of other species would lead us to anticipate. The several varieties must of necessity have their own habitats, and their own surroundings, if they were subject to the same laws of life as other animals and vegetables; and each must fulfil its own purpose in the economy of Nature. In the progress of this investigation, it was found that some of these minute organisms were traceable as parasites in other living beings; and the strong presumption was that they were associated with certain morbid states. It further became evident that this development was not restricted by the action of chemical laws, but that the processes of putrefaction and fermentation might be superseded by morbid processes which have hitherto, at all events, refused to be classed under chemical or physical laws. One additional step led to the conclusion that, in each instance, the special organism was of a different kind. It would be somewhat rash to assert that all of these facts have yet been brought into the domain of laws of Nature. But if we may trust some of the most careful observers, we must admit that certain morbid states (*e.g.*, splenic fever) are accompanied of necessity by the development of a specific bacillus (*e.g.*, the bacillus anthracis), and that this

bacillus introduced into a healthy animal who is susceptible will produce in it an attack of the same disease. And further, that while the bacillus lactis will excite fermentation in milk, and cannot produce splenic fever, the bacillus anthracis may fall into milk without producing any acidity.

Yet another idea presented itself apparently unbidden to the minds of some of these inquirers. In the proper sense of questioning Nature, an attempt had been made to infect a susceptible animal with splenic fever by injecting blood from a diseased animal, which, by delicate manipulation, was supposed to be freed from the germs of the bacillus, and the answer given was that, even so, a mild form of the disease was communicated. Out of this the inquiry necessarily sprang: In what consists this mild form of the disease, and what are the means by which it may be excited? Separate observations had been teaching that a given menstruum, or what is now called a nutritive fluid, ceases after a certain time to be capable of reproducing the particular form of organism for which, in the first instance, it served as a matrix. This decadence of the growth could at any period be arrested by a change in the nutritive fluid. By experiment, it has been ascertained that, during the period of degeneration, the disease produced by inoculation becomes milder and milder; while, on the contrary, it increases in intensity as the

reproductive powers of the germs become increased and their numbers multiply. At present, two factors seem to be recognised as determining the severity of the attack due to inoculation, viz., the vitality and reproductive power of the germs, and the number introduced.

It would be idle to speculate further on the ideas thus suggested. Can it be that the specific fevers of the human race have each their own bacillus? May the exhaustion of the menstruum serve as an explanation of their termination in individual cases; and the loss of reproductive powers be the cause of the termination of an epidemic? May we hope in each of them some day to inoculate a mild form of the disease which will preserve the individual from a more severe attack? Whatever answers may in the future be given to these and similar questions, the definite results already arrived at in the two diseases which have formed the subjects of investigation cannot be ignored, and can only be set aside by showing them to be exceptional instances. I feel bound to affirm that, in my judgment, the course of inquiry pursued has been in strict accordance with Harvey's principle of questioning Nature by way of experiment; and I cannot but believe that the answers do really present what may be called "Laws of Nature."

I have done. But I cannot conclude this Oration without a reference, however brief, to the memorial

about to be erected to Harvey in his native town, in recognition of his great work, more than three hundred years after his birth. Tardy as this particular acknowledgment is, it must not be regarded as an evidence that his work has only now begun to be appreciated. His fame needed no such monument to bring it afresh to our memory ; his name will last when the marble has crumbled into dust. While our race continues on this globe, he will be remembered as one of the great pioneers in scientific research ; while this College lasts, he will be remembered as one of its most sincere well-wishers, one of the kindest of our Fellows. If we be but true to ourselves and to him, the College will yet triumph over the attacks of its foes. But the temptation which assails every practitioner of medicine must be stoutly resisted, sternly put aside. The race for fame and popularity is not for us as seekers after truth. The acquisition of wealth is not for any of us a legitimate aim. Pecuniary rewards will attend success, however attained ; but success is not necessarily a test of merit. Truth must be sought for its own sake, and not because its publication brings renown to its discoverer, and opens up to him the avenues to future distinction. If such a course calls for some self-abnegation on the part of our junior Fellows, they will bear with me, I am sure, if, as one of the seniors, I remind them that thus alone

can they have the enduring reward of an approving conscience, and the approbation of those whom we all recognise as the leaders we should choose to follow. May the College never want worthy representatives of the character and conduct of Harvey ; may it never fail in having such a worthy head as our present President.

THE END.



